MEMORANDUM

To: Amy Hambrick, U.S. EPA, Sector Policies and Programs Division/Natural Resources and Commerce Group

From: Eastern Research Group, Inc.

Date: January 2011

Subject: Revised Estimation of Impacts for New Units Constructed Within Five Years After Promulgation of the SSI NSPS

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA), under section 129 of the Clean Air Act (CAA), is required to develop new source performance standards (NSPS) regulating emissions of nine pollutants from sewage sludge incineration (SSI) units: hydrogen chloride (HCl), carbon monoxide (CO), lead (Pb), cadmium (Cd), mercury (Hg), particulate matter (PM), total mass basis dioxins/furans (TMB PCDD/PCDF) and toxic equivalency basis dioxin/furans (TEQ PCDD/PCDF), nitrogen oxides (NO_x), and sulfur dioxide (SO_2). This memorandum describes the estimation of cost and emission impacts of complying with the NSPS. Section 2.0 discusses the estimation of the number of new sources that may be constructed within five years after promulgation of the SSI NSPS. Section 3.0 discusses the methodology used to estimate cost and emissions reductions from complying with the maximum achievable control technology (MACT) floor level of control required in the NSPS, and Section 4.0 discusses control options more stringent than the MACT floor level of control.

2.0 ESTIMATION OF NEW SOURCES

Several significant changes have occurred to SSI units in the past 20 years. The U.S. EPA's Office of Water (OW) set emission and discharge standards for sewage sludge disposal methods (including incineration) in 1993 (40 CFR part 503). As a result of the 503 rule, many wastewater treatment facilities chose to use alternative methods for disposing of sewage sludge, such as landfilling or land application, rather than try to meet the incineration requirements. Many of the closed incinerators had been operated by municipalities or agencies serving smaller populations, i.e., less than 50,000 people.[1]

The general trend has also been for facilities still incinerating sewage sludge to replace older multiple hearth (MH) units with newer fluidized bed (FB) units because of better emissions performance, savings in fuel cost, and flexibility in operation. Since 1988, there have been over 40 new FB systems installed, with 11 replacing existing MH units.[2] Discussions with the National Association of Clean Water Agencies (NACWA), the

industry trade group, indicated that only FB units are likely to be constructed in the future.[3] Consequently, it was assumed that any new units that would be built after promulgation of the NSPS would be a FB design.

In order to estimate the number of new sources that may be constructed in the five years following promulgation of the NSPS, the number of sources being constructed five years prior to proposal of the rule was reviewed to determine if there was a trend. Under EPA's "New Source Review" (NSR) program, if a company is planning to build a new plant or modify an existing plant such that air pollution emissions will increase by a large amount, then the company must obtain an NSR permit. The NSR permit is a construction permit which requires the company to minimize air pollution emissions by changing the process to prevent air pollution and/or installing air pollution control equipment. The NSR program defines control levels based on the type of program the source is subject to: reasonably available control technology (RACT), best available control technology (BACT), or lowest achievable emissions reduction (LAER). Information from the EPA's RACT/BACT/LAER database contains case-specific information on the "Best Available" air pollution technologies that have been required to reduce the emission of air pollutants from stationary sources. This information has been provided by State and local permitting agencies. The database was searched for sewage sludge incineration units permitted or constructed since 2005. The search results showed two fluidized bed (FB) units at the R.L. Sutton Water Reclamation facility in Georgia were permitted in 2005 and completed construction in 2008 and are currently in operation.[4] Additional information collected from State environmental agencies and permits indicated an additional 3 units at the Mill Creek Wastewater Treatment Plant in Ohio were expected to finish construction and be in operation in 2010.[5] All of these new FB units were replacements for MH units.

Based on the data collected, and assuming the trend in construction continues, five additional FB units will be permitted to be constructed in five years after the NSPS is proposed. However, given the time necessary to review and assess the requirements of the NSPS and plan, permit, and construct incineration units, it is unlikely that all five would be in operation in the five years. For this analysis, it was assumed at least two new FB units would be constructed and in operation in this time period.

3.0 METHODOLOGY USED TO ESTIMATE COST AND EMISSION REDUCTIONS OF THE MACT FLOOR LEVEL OF CONTROL

Cost and emission reductions for new units complying with the NSPS were calculated by: (1) determining the controls that these units would most likely apply if the NSPS were not in place (referred to as the baseline level of control), (2) calculating the cost of complying with the NSPS emission levels, and (3) estimating the emissions reduction from complying with the NSPS emissions levels. Each of these steps is discussed in more detail.

3.1 Determining Baseline Controls

The baseline level of control that new units would likely implement (in the absence of the NSPS) was determined from reviewing the most common controls used at existing FB units, as shown in the SSI inventory memorandum[1] and the database revisions memorandum.[6] Table 3-1 shows the distribution of controls. Based on this information, the baseline controls assumed for the new units are a combination of venturi scrubbers and impingement scrubbers. Data gathered on the controls currently used at FB units indicates that few FB units operate an afterburner, because their CO emissions are already low. However, the analysis includes costs for afterburners because ACI/FF are needed for mercury control, and in order for these controls to operate effectively, an afterburner would need to be installed to keep moisture levels low (alternatively, a regenerative thermal oxidizer or waste-heat boiler could be used). In reality, new FB units that are constructed are likely to be designed to meet the CO level. Costing an afterburner provides a conservative estimate of costs.

3.2 Calculating Baseline Emissions

The SSI baseline emissions memorandum[7] documents the calculation of baseline emissions from existing FB SSI units. Baseline emissions are calculated on a mass basis by multiplying the concentration of the pollutant in the emission stream, flow rate of the emission stream, and the hours of operation of the SSI unit. For units where no emissions test data were collected, baseline emissions were generally estimated using an average uncontrolled concentration and applying reduction efficiencies associated with the control devices located at each SSI unit for each pollutant. Baseline concentrations used in the new source analysis are the same baseline emissions applied to fill data gaps for FB units having a venturi/impingement scrubber combination.

A default flue gas flow rate was determined for FB units based on the average of known flow rate data for this subcategory. The data is described in further detail in the database revisions memorandum.[6] Similarly, default values for sludge feed rates, unit capacities, and operational hours were determined by averaging the known data for these parameters for the FB subcategory.

Table 3-2 shows the average concentration factors, average dry sludge capacity, and operating hours, as well as other default parameters necessary for the costs. These factors were applied to each new unit estimated to be constructed within the next five years. Table 3-3 shows the estimated baseline concentrations for new units.

3.3 Calculating Costs and Emission Reductions

Costs were calculated using the procedures and algorithms discussed in the memorandum, "Revised Cost and Emissions Reduction of Complying with the MACT Floor for Existing SSI Units".[8] Control devices costed out were those that would be

necessary to meet the MACT floor level of control for new sources. Wet electrostatic precipitators (WESP) can be used for PM control; however, because an ACI/FF/afterburner combination was determined to be necessary for new sources to meet the NSPS limits for Hg and PCDD/PCDF, a FF was assumed to be sufficient for PM and lead control. Table 3-3 shows the comparison of baseline emissions levels to MACT floor levels to determine the amount of pollutant reduction needed and the types of control devices that would be used to meet the levels. Emission reductions from applying the MACT floor requirements to the baseline emission levels are presented in Table 3-3. The inputs to the cost algorithm are presented in Table 3-2.

Table 3-4 shows the estimated total capital investment (TCI) and total annual costs (TAC) calculated for a single unit using the cost algorithms previously discussed. The table also shows the monitoring, testing, reporting, and recordkeeping costs. The table shows the TCI and TAC for the two new FB units that are assumed to be constructed and in operation in the five years after proposal of the NSPS. Table 3-5 shows the detailed capital and annual costs of continuous CO emissions monitoring for each new SSI unit (continuous CO emissions monitoring costs were not presented in the "Cost and Emissions Reduction of Complying with the MACT Floor for Existing SSI Units" memorandum because it was an alternative monitoring requirement and not required).

4.0 ANALYSIS OF BEYOND THE FLOOR OPTIONS

The control technologies costed to achieve the MACT floor levels are generally the most effective controls available: fabric filters for PM, Cd, Pb; activated carbon injection with fabric filters and afterburners/RTO for Hg and PCDD/PCDF; afterburners for CO; and packed bed scrubbers for HCl and SO_2. In addition, incremental additions of activated carbon have not been proven to achieve further reductions above the projected flue gas concentration estimated to achieve the limits for new sources. Data gathered does not indicate that any FB units operate NO_x controls, such as selective noncatalytic reduction, selection catalytic reduction, or flue gas recirculation because the NO_x emissions are already low. To meet the NSPS NO_x limit SNCR costs were calculated. In reality, new FB units that are constructed are likely to be designed to meet the NO_x level using low NO_x burners. Costing an SNCR provides a conservative estimate of costs. No beyond the floor options were analyzed for this analysis because we are not aware of any technologies or methods to achieve emission limits more stringent than the MACT floor limits for new units, which are based on the lowest emitting FB units.

5.0 REFERENCES

1. Inventory Database for the Sewage Sludge Incineration Source Category. Memorandum from Eastern Research Group to Amy Hambrick, U.S. Environmental Protection Agency. June 2010.

2. A Comparison of Fluid Bed and Multiple Hearth Biosolids Incineration. Ky Dangtran, John Mullen, and Dale Mayrose. Paper presented at the 14th Annual

Residuals and Sludge Management Conference. February 27-March 1, 2000, Boston MA.

3. Meeting minutes from Sewage Sludge Incinerator Informational Meeting with the National Association of Clean Water Agencies (NACWA). Research Triangle Park, NC. August 25, 2009

4. R.L. Sutton Water Reclamation Wastewater Treatment permit # 4953-067-0018-V-01-1 RACT/BACT/LAER Clearinghouse. http://cfpub.epa.gov/rblc/

5. Mill Creek Wastewater Treatment Plant. Final permit to install. Permit Application #14-05837.

6. Post-Proposal SSI Database Revisions and Data Gap Filling Methodology. Memorandum from Eastern Research Group, Inc. to Amy Hambrick, U.S. Environmental Protection Agency. January 2011.

7. Revised Estimation of Baseline Emissions From Existing Sewage Sludge Incineration Units. Memorandum from Eastern Research Group to Amy Hambrick, U.S. Environmental Protection Agency. January 2011.

8. Revised Cost and Emissions Reduction of Complying with the MACT Floor for Existing SSI Units. Memorandum from Eastern Research Group to Amy Hambrick, U.S. Environmental Protection Agency. January 2011.